9 SERIAL NUMBER RESTORATION

9.1 Introduction

Many items manufactured today have serial numbers for identification that are usually die stamped. This process compresses the material in the area immediately surrounding and a short distance below the penetration of the die. Serial numbers are removed and/or obliterated in a variety of ways and may be restored if the removal/obliteration is not taken past the previously mentioned compression zone, by using methods such as polishing, Magnaflux®, chemical or electrochemical restoration, or heat restoration.

9.2 Safety Considerations

Examinations performed in the Firearm and Toolmark Section are inherently hazardous. These procedures involve hazardous chemicals, firearms, ammunition, and power tools. All hazardous procedures must be performed in compliance with the DFS Safety Manual.

9.3 Preparation

NOTE: ALWAYS ADD ACID TO WATER. NEVER ADD WATER TO ACID.

9.3.1 Fry's Reagent

- To 90 grams of Cupric Chloride (CuCl2)
- Add 100 milliliters of distilled water (H20)
- Add 120 milliliters of Hydrochloric Acid (HCl)
- Store solution in an appropriate, sealed container that is marked with the date and initials of the preparer
- Record in the Firearms Quality Record Book

9.3.2 Turner's Reagent

- To 2.5 grams of Cupric Chloride (CuCl2)
- Add 40 milliliters of Hydrochloric Acid (HCl)
- Add 25 milliliters of Ethyl Alcohol
- Add 30 milliliters of distilled water (H20)
- Store solution in an appropriate, sealed container that is marked with the date and initials of the preparer
- Record in the Firearms Quality Record Book

9.3.3 Davis's Reagent

- To 5 grams of Cupric Chloride (CuCl2)
- Add 50 milliliters of distilled water (H20)
- Add 50 milliliters of Hydrochloric Acid (HCl)
- Store solution in an appropriate, sealed container that is marked with the date and initials of the preparer
- Record in the Firearms Quality Record Book

9.3.4 25% Nitric Acid Solution

- To 75 milliliters of distilled water (H20)
- Add 25 milliliters of Nitric Acid (HNO3)
- Store solution in an appropriate, sealed container that is marked with the date and initials of the preparer
- Record in the Firearms Quality Record Book

9.3.5 Acidic Ferric Chloride Solutions

- To 25 grams of Ferric Chloride (FeCl3)
- Add 100 milliliters of distilled water (H20)
- Add 25 milliliters of Hydrochloric Acid (HCl)
- Store solution in an appropriate, sealed container that is marked with the date and initials of the preparer
- Record in the Firearms Quality Record Book

9.3.6 Ferric Chloride Solution

- To 25 grams of Ferric Chloride (FeCl3)
- Add 100 milliliters of distilled water (H20)
- Store solution in an appropriate, sealed container that is marked with the date and initials of the preparer
- Record in the Firearms Quality Record Book

9.3.7 10% Sodium Hydroxide Solution

- To 100 milliliters of distilled water (H2O)
- Slowly add 10 grams of Sodium Hydroxide (NaOH)
- Store solution in an appropriate, sealed container that is marked with the date and initials of the preparer
- Record in the Firearms Quality Record Book

9.3.8 Hydrofluoric Acid Solution

WARNING! Concentrated Hydrofluoric Acid (HF) is a "particularly hazardous substance" and must be handled using appropriate PPE (laboratory coat, thick "rubber" gloves, and face shield). Calcium gluconate gel must be available in the work area. HF may not be handled when working alone.

- To two (2) parts of Concentrated Hydrofluoric Acid (HF)
- Add one (1) part of Nitric Acid (HNO3)
- Add three (3) parts of Glycerol
- Store solution in an appropriate, sealed container that is marked with the date and initials of the preparer
- Record in the Firearms Quality Record Book

9.3.9 Aqua Regia Solution

- To 75 milliliters of Hydrochloric Acid (HCl)
- Add 25 milliliters of Nitric Acid (HNO3)
- Store solution in an appropriate, loosely sealed container that is marked with the date and initials of the preparer
- Record in the Firearms Quality Record Book

9.3.10 Cupric Chloride in Nitric Acid Solution

- To five (5) grams of Cupric Chloride (CuCl2)
- Add 100 milliliters of distilled water (H2O)
- Add three (3) milliliters of Hydrochloric Acid (HCl)
- Store solution in an appropriate, sealed container that is marked with the date and initials of the preparer
- Record in the Firearms Quality Record Book

9.3.11 Zinc Alloy Etching Solutions

- Solution 1 - To two (2) milliliters of distilled water (H2O), add 98 milliliters of Phosphoric Acid (H3PO4)
  Solution 2 - To 95 milliliters of distilled water (H2O), add five (5) milliliters of Nitric Acid (HNO3)
- Store solution in an appropriate, sealed container that is marked with the date and initials of the preparer
- Record in the Firearms Quality Record Book

9.3.12 Griffin's Reagent

- To 30 grams of Cupric Chloride (CuCl2)
- Add 30 milliliters of distilled water (H2O)
- Add 30 milliliters of Hydrochloric Acid (HCl)
- Add 120 milliliters of Methanol (CH3OH)
- Store solution in an appropriate, sealed container that is marked with the date and initials of the preparer
- Record in the Firearms Quality Record Book

9.4 Instrumentation

- Scale/Balance
- Low voltage DC power source
- UV light source (if 14AM Prepared Bath is being used)
- Yoke magnets
- Y-7 AC/DC Yoke electromagnet

9.5 Minimum Analytical Standards and Controls

NONE

9.6 Procedure or Analysis

The evidence will be marked in accordance with the Quality Manual. Initial inspection of the serial number area should include observations of coating, trace material, character remnants, and the method of obliteration. Initial observations should be recorded in the notes by documenting and/or photographing the serial number area.

Serial numbers are removed and/or obliterated in a variety of ways and may be restored if the removal/obliteration is not taken past the previously mentioned compression zone, by using methods such as polishing, magnetic or Magnaflux®, chemical or electrochemical restoration, or heat restoration.

9.6.1 Polishing Procedure

The polishing procedure is a desirable method used to remove prior obliteration by polishing, grinding, and filing scratches that obscure the serial number. The polishing procedure can be effective independently, but is more often used in conjunction with various chemical or heat-restoration procedures.

- Polish the area of the obliteration using either a Dremel-type tool with a sanding/polishing disc or fine-grit sandpaper
- Depending on the extent of the obliteration, continue polishing until the surface is mirror-like, removing all scratches
- If the obliteration is severe, it may not be possible or desirable to remove all the scratches
- Observations should be recorded in examiner's notes by documenting and/or photographing the serial number area

9.6.2 Magnetic or Magnaflux® Procedure

The magnetic procedure or Magnaflux® technique is used by metallurgists to detect surface or subsurface flaws in iron or steel. Magnetic particles, applied to a magnetized specimen, outline the obliterated characters in a successful restoration. This procedure, in conjunction with the polishing procedure, is an effective way to restore an obliterated serial number in magnetic metal. The Magnaflux® technique is nondestructive, and can be applied without affecting other restoration methods.

- Determine the serial number medium's physical properties, i.e. magnetic or non-magnetic
- Determine whether the specimen is suitable for testing with Magnaflux® by placing a magnet on the area of obliteration
- The specimen is suitable if it can be magnetized
- Clean the area of obliteration with the SKC-S Cleaner/Remover by spraying this onto the surface and wiping, allowing to dry before proceeding
- Apply appropriately prepared 9CM or 7HF Bath to the area of obliteration with a disposable pipette
- Place a magnet behind the area of obliteration, with the magnetic poles on either side of the area
- This placement may be adjusted to reveal more or different areas of the obliteration
- If 14AM (Fluorescent) prepared bath is being used, observe the characters under a black light
- Observations should be recorded in examiner's notes by documenting and/or photographing the serial number area

9.6.3 Chemical Procedure

The chemical-restoration procedure is suitable for restoration of serial numbers in metal. This procedure, in conjunction with the polishing procedure, is an effective way to restore an obliterated serial number in metal.

Selection of the appropriate chemical reagent, based on initial observations, may include magnetic media or non-magnet media.

Appropriate magnetic media reagent choices:

- Fry's Reagent
- Turner's Reagent
- Davis's Reagent
- 25% Nitric Acid Solution
- Aqua Regia

Appropriate non-magnetic media reagent choices:

- Ferric Chloride Solution
- Acidic Ferric Chloride Solution
- 25% Nitric Acid Solution
- 10% Sodium Hydroxide Solution
- Hydrofluoric Acid Solution

As appropriate, apply the chemical solution to the area of obliteration utilizing cotton tip applicators or swabs that have been moistened with the appropriate chemical reagent or solution and note any numbers or characters that become visible. Observations should be recorded in examiner's notes by documenting and/or photographing the serial number area

9.6.4 Electrochemical Procedure

The electrochemical procedure is a form of chemical restoration that is enhanced by the application of voltage that speeds the oxidation process of metal. This technique, in conjunction with the polishing procedure, is an effective way to restore an obliterated serial number in metal. Selection of the appropriate chemical reagent, based on initial observations, may include magnetic media or non-magnetic media.

Appropriate magnetic media reagent choices:

- Fry's Reagent
- Turner's Reagent
- Davis's Reagent
- 25% Nitric Acid Solution
- Aqua Regia

Appropriate non-magnetic media reagent choices:

- Ferric Chloride Solution
- Acidic Ferric Chloride Solution
- 25% Nitric Acid Solution
- 10% Sodium Hydroxide Solution
- Hydrofluoric Acid Solution

The electrochemical procedure follows.

- The electrochemical technique requires the attachment of the item to the positive terminal of a power supply via the use of metal alligator clips
- Thoroughly soak the cotton tip of an applicator with the appropriate etching chemical solution and attach the moistened cotton tip to the negative terminal of the power supply via another metal alligator clip, being certain to do so on a moistened area at the base of the cotton tip
- Turn on the power supply and increase the voltage gradually until the reaction appears
- Wipe the area of obliteration with the moistened cotton tip, being careful to not touch the surface of the item with the metal alligator clips and note any numbers or characters that become visible
- Observations should be recorded in the notes by documenting and/or photographing the serial number area

9.6.5 Heat Procedure

The Heat-Restoration procedure is suitable for restoration of serial numbers in plastic. The die stamping, or embossing process, is a form of "cold-working" plastic. This procedure, in conjunction with the polishing procedure, is an effective way to restore an obliterated serial number in plastic.

- The heat technique requires the application heat to the area of obliteration utilizing a high intensity lamp or heat gun
- Continue the application of heat until the plastic in the obliterated area starts to liquefy and note any numbers or characters that becomes visible
- Observations should be recorded in the notes by documenting and/or photographing the serial number area

9.6.6 Interpretation of Results

Interpretation of results would include full restoration, partial restoration, or unsuccessful restoration. A full

restoration would be a total recognition of all obliterated characters. A partial restoration would be recognition of all obliterated characters less than the total being sought. An unsuccessful restoration would be no recognition of any obliterated characters. Notes should include if the restoration procedure was full, partial, or unsuccessful.

9.6.7 Verifications

A second examiner will verify all restoration results. Documentation in case notes shall be in the form of a notation, hand written by the verifying examiner, and shall delineate the obliterated characters that have been restored and/or not restored, along with the date verified and the verifier's initials.

9.6.8 Reporting Formats

Reporting of Serial Number Restoration Results

Full restoration:

The obliterated serial number on the item __ pistol/revolver/rifle/shotgun was restored to read _____.

Partial restoration:

The obliterated serial number on the item __ pistol/revolver/rifle/shotgun was partially restored to read _'_'_'_'_'_.

Unsuccessful restoration:

Attempts to restore the obliterated serial number on the item __ pistol/revolver/rifle/shotgun were unsuccessful.

9.7 Appropriate Appendices

Appendix - Work Sheets

Appendix - Calibration Standards

9.8 References

Bureau of Alcohol, Tobacco and Firearms Laboratory. Serial Number Restoration Handbook. 1999.

Polk, Donald, E. and Giessen, Bill, C. "Metallurgical Aspects of Serial Number Recovery". AFTE Journal. Vol. 21, No. 2, p. 174.

Treptow, Richard, S. Handbook of Methods for the Restoration of Obliterated Serial Numbers. NASA. 1978.

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